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**UNITED STATES PATENT APPLICATION**

of

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**Daniel C. Kennedy, II**

for

**Method and Apparatus for Stretching a Hamstring**

TO THE COMMISSIONER OF PATENTS AND TRADEMARKS:

Your petitioners,

**Thomas Bodily** (whose residence is Salt Lake City, Utah), and

**Daniel C. Kennedy, II** (whose residence is Salt Lake City, Utah),

citizens of the United States, pray that letters patent may be granted to them as the inventors of a **Method and Apparatus for Stretching a Hamstring** as set forth in the following specification.

# Method and Apparatus for Stretching a Hamstring

This application claims the benefit of U.S. Provisional Patent Application No. 60/444,756, filed February 3, 2003.

## BACKGROUND OF THE INVENTION

### Field of the Invention

The present invention relates generally to a method and apparatus for stretching a hamstring in a patient, such as a person with cerebral palsy.

### Related Art

Over 500,000 Americans are affected by cerebral palsy, a non-progressive disorder of the central nervous system that impairs control of movement. There are many types and degrees of severity, but often results in increase in tone in the hamstrings, which leads to abnormal gait and possible bone deformities, particularly in children.

Conventional treatment includes surgery to lengthen three tendons behind the knee. Afterwards, a splint or cast is used. The surgery can require a hospital stay of 2-3 days, and the splint or cast can be required for 4-6 weeks. In addition, an additional resting splint may be required. The surgery is often performed on children between the ages of 7 and 12. Unfortunately, the surgery can weaken the hamstrings. While surgery results in short term improvement (~6-12 months), the condition often returns to pre-operative levels in the long term (~60 months).

## SUMMARY OF THE INVENTION

It has been recognized that it would be advantageous to develop a method and apparatus for lengthening the hamstring while avoiding surgery, particularly during childhood.

The invention provides a physical therapy apparatus to stretch a hamstring in a leg of a patient. The apparatus can include a leg board pivotally coupled to a seat back. The seat back receives a torso of the patient, while the leg board receives the leg of the patient. The apparatus also can include means for securing the leg of the patient to the leg board to maintain the legs in a substantially straight configuration. For example, a knee strap can be coupled to the leg board and positioned to extend over the patient's legs adjacent the knees.

The apparatus also can include means for selectively adjusting and maintaining an angular orientation between the seat back and the leg board.

The invention also provides a method for stretching a hamstring of a leg of a patient. The patient is positioned on an apparatus having a seat back and a leg board pivotally coupled together with a torso of the patient disposed against the seat back and the leg of the patient disposed against the leg board. The leg of the patient is secured to the leg board in a substantially straight configuration. A desired initial obtuse angle is selectively formed between the seat back and the leg board, and thus the leg and torso of the patient, to stretch the hamstring of the leg of the patient. The desired obtuse angle is maintained for a predetermined initial period of time.

Additional features and advantages of the invention will be apparent from the detailed description which follows, taken in conjunction with the accompanying drawings, which together illustrate, by way of example, features of the invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1a is a perspective view of a physical therapy apparatus in accordance with an embodiment of the present invention, shown in an initial position;

FIG. 1b is a perspective view of the physical therapy apparatus of FIG. 1a, shown in a subsequent position;

FIG. 2a is a side view of the physical therapy apparatus of FIG. 1a, shown in the initial position;

FIG. 2b is a side view of the physical therapy apparatus of FIG. 1a, shown in the subsequent position;

FIG. 3a is a front view of the physical therapy apparatus of FIG. 1a, shown in the initial position;

FIG. 3b is a front view of the physical therapy apparatus of FIG. 1a, shown in the subsequent position;

FIG. 4a is a top view of the physical therapy apparatus of FIG. 1a, shown in the initial position; and

FIG. 4b is a top view of the physical therapy apparatus of FIG. 1a, shown in the subsequent position.

**DETAILED DESCRIPTION**

Reference will now be made to the exemplary embodiments illustrated in the drawings, and specific language will be used herein to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Alterations and further modifications of the inventive features illustrated herein, and additional applications of the principles of the inventions as illustrated herein, which would occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the invention.

As illustrated in FIGs. 1a-4b, a physical therapy or chair-like apparatus, indicated generally at 10, in accordance with the present invention is shown for stretching a hamstring of leg of a patient. The patient may be afflicted with a medical condition, such as cerebral palsy. Physical therapy is an example of one field that can benefit from use of the present invention.

The apparatus 10 includes a leg board 14 pivotally coupled to a seat back 18 with a pivot 22 or hinge. The leg board 14 can be a seat-like panel, plate or lower portion that is substantially rigid, and substantially flat and straight. The leg board 14 can have a length sized to substantially receive the entire length of the patient's leg. The patient can sit on the leg board 14 with the leg board 14 receiving the patient's buttocks and legs, while the patient's torso is disposed against the seat back 18. Thus, the patient can be disposed in the apparatus 10, or on the leg board 14, with the patient's legs extending substantially straight along the leg board 14, shown in phantom lines in FIGs. 2a and 2b. A knee strap 26 can be coupled to the leg board 14 and positioned to extend across the seat, and thus the patient's legs, at a position above the patient's knees. The strap 26 can form a loop with the leg board 14 that can be tightened to hold the patient's legs flat against the leg board 14. The strap 26 is one example of a means for securing the patient's legs to the leg board 14 to maintain the legs in a substantially straight configuration, shown in phantom lines in FIGs. 2a and 2b. Other means for securing the patient's legs can include flexible belts or straps with buckles, hook-and-loop type fasteners; or rigid bands, bars; etc. A belt or seatbelt 30 can be coupled to the leg board 14 or seat back 18, and can extend around the patient's waist to secure the patient to the apparatus 10, and to secure the patient's waist adjacent the pivot 22.

An angle $\Theta$ between the leg board and seat back 14 and 18 can be selectively adjusted and maintained. The leg board and seat back 14 and 18 can be maintained at an obtuse angle, or between 90 and 180 degrees, with respect to one another. In accordance with one aspect

of the present invention, the angle Θ between the leg board and seat back 14 and 18 can be adjusted between approximately 150 to 90 degrees.

For example, the leg board 14 and seat back 18 can have an initial angle as great as about 150 degrees, as shown in FIGs. 1a and 2a. As another example, the leg board and seat back can have a subsequent angle less than 150 degrees, and as low as about 90 degrees, as shown in FIGs. 1b and 2b.

The angle Θ can be adjusted and maintained by an adjustment mechanism extending between the leg board 14 and the seat back 18. For example, the adjustment mechanism can be coupled underneath the leg board 14, and can extend to an extension or lower section of the seat back 18. The adjustment mechanism can include an elongated threaded rod 34 coupled between the leg board 14 and the seat back 18. The treaded rod 34 can engage a threaded coupler 38 secured to one of the leg board 14 and/or the seat back 18, and can be rotatable. Rotating the rod 34 causes the leg board 14 and the seat back 18 to move with respect to one another. The other end of the rod can be rotatably coupled to the other of the leg board or seat back. A rotating handle 42 can be coupled to the threaded rod to rotate the rod and allow manual adjustment of the angle. Alternatively, a motor can be coupled to, and rotate, the rod.

A U-shaped mount 46 can be coupled to the leg board 14, with one end of the threaded rod 34 rotatably coupled to the mount, such as through a bearing. Ends of the mount can be pivotally coupled to opposite sides of the leg board 14, with the bearing between the ends. A brace 50 can extend between opposite sides of the seat back 18, and can carry the threaded coupler 38. The threaded coupler can be pivotally coupled to the brace, or the brace can be pivotally coupled to the seat back. Thus, the threaded rod 34 can extend between the brace 50 and the U-shaped mount 46.

The adjustment mechanism or threaded rod is one example of means for selectively adjusting and maintaining an angular orientation between the seat back and the leg board. Other means for adjusting and maintaining the angle can include, for example, a gear system, such as a planetary gear system; a locking mechanism with a pin receivable in one of a plurality of holes; etc. The means for adjusting and maintaining the angle can continuously adjust the angle through an infinite range of angles, or can discretely adjust the angle through a plurality of discrete angles.

The chair apparatus 10 also can include a base 54 supporting the seat back 18 and the leg board 14, and can be disposed on a support surface, such as the ground or floor. The base 54 can include a pair of parallel beams 58 or rails. Feet 62 can be disposed on the ends of the

beams 58 or base, and can maintain the base or beams above the support surface. An intermediate beam 66 can extend between the pair of beams 58. Collars 70 can be disposed on the ends of the intermediate beam 66, and slidably disposed around the parallel beams 58, so that the intermediate beam 66 can slide along the length of the parallel beams 58. A lower end of the seat back 18 can be coupled to the intermediate beam 66 and/or collars 70, so that the lower end can slide with respect to the parallel beams 58, as discussed below. A retaining pin 74 can extend through the collar 70 and into one of a plurality of holes 78 formed in the parallel beams 58 to selectively fix the collars 70 with respect to the parallel beams 58.

Support arms 82 can extend between the base 54 or beams 58 and the seat back 18. A lower end of the support arms 82 can be pivotally coupled to the base 54 or beams 58, and an upper end pivotally coupled to the seat back 18, or at the pivot 22. The support arms 82 can support the seat back 18.

The seat back 18 can be oriented substantially vertically, as shown in FIGs. 1b and 2b, so that the patient can remain relatively active during therapy. In the initial position or angle, the leg board and seat back can have a relative angle of about 150 degrees. Thus, the seat back 18 can be tilted into an inclined position, as shown in FIGs. 1a and 2a, in which the seat back forms an obtuse angle with respect to the base or support surface, in order to lower the center of gravity of the apparatus and patient, and thus increase stability. As the angle between the leg board and seat back 14 and 18 is decreased or decreased, the lower end of the seat back 18 can slide with respect to the base or beams.

A tray 86 can be coupled to the seat back 18 so that it is disposed in front of, and spaced-apart from, the seat back. As discussed above, the patient can be active during therapy. Thus, the patient can utilize the tray 86 for writing or other activities. The tray 86 can be pivotally coupled to the seat back 18 at pivot 90. In addition, the tray 86 can include lateral sides that couple to and extend from the seat back 18. The sides of the tray 86 can provide lateral support to the patient, or to the patient's torso, to resist the patient from displacing laterally during use.

The leg board 14 and the seat back 18 can include a perimeter frame and a panel extending between the frame. As described above, the panel and frame can be substantially flat and straight. A pad can be disposed on the panel for comfort.

The perimeter frame, beams, arms, braces, etc., can be formed of metal, such as steel, aluminum or alloy tubing, bent and/or welded to form the desired shapes. Alternatively, the material can be plastic or other light weight material. The leg board and seat back also can

include a panel extending between the frame. The panels can be a wood or plastic board. The panels also can be covered, and/or can include padding.

A method for stretching a patient's hamstring, treating a person with cerebral palsy, and/or using the chair apparatus 10 described above, includes positioning the patient on the chair apparatus 10. The patient's buttocks and legs can be disposed against the leg board 14, and the patient's torso can be disposed against the seat back 18. The patient's legs can be oriented substantially straight and secured to the leg board with the strap 26. The strap 26 can extend across the patient's thighs above the knees. In addition, the belt 30 can be secured across the patient to position the patient's hips at or adjacent the pivot 22.

The angle between the leg board 14 and seat back 18, and thus, the leg and torso, can be selectively formed at a desired initial obtuse angle between the seat back and the leg board. The initial angle can be formed after the patient is secured to the chair apparatus, or before. When beginning treatment or therapy, it is anticipated that the angle will be relatively large, such as approximately 150 degrees. The angle can be continually reduced during subsequent treatments. The desired angle is maintained for a predetermined initial period of time. It is anticipated that the time period will be between approximately 20 to 40 minutes. During the same treatment, the angle between the seat back and the leg board, and thus the leg and torso of the patient, can be reduced to a subsequent smaller angle. For example, the handle can be rotated. The angle can be reduced while the patient is disposed in the chair apparatus. The subsequent smaller angle can be maintained for another predetermined period of time. Thus, the angle can be repeatedly reduced over time or between sequential, subsequent treatments. The treatment can be maintained over time.

It is to be understood that the above-referenced arrangements are illustrative of the application for the principles of the present invention. It will be apparent to those of ordinary skill in the art that numerous modifications can be made without departing from the principles and concepts of the invention as set forth in the claims.